

# Emission channeling with short-lived isotopes

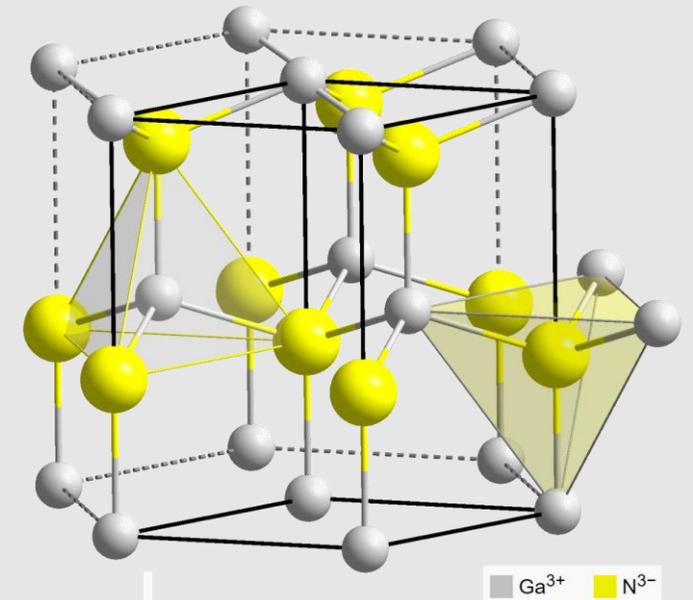
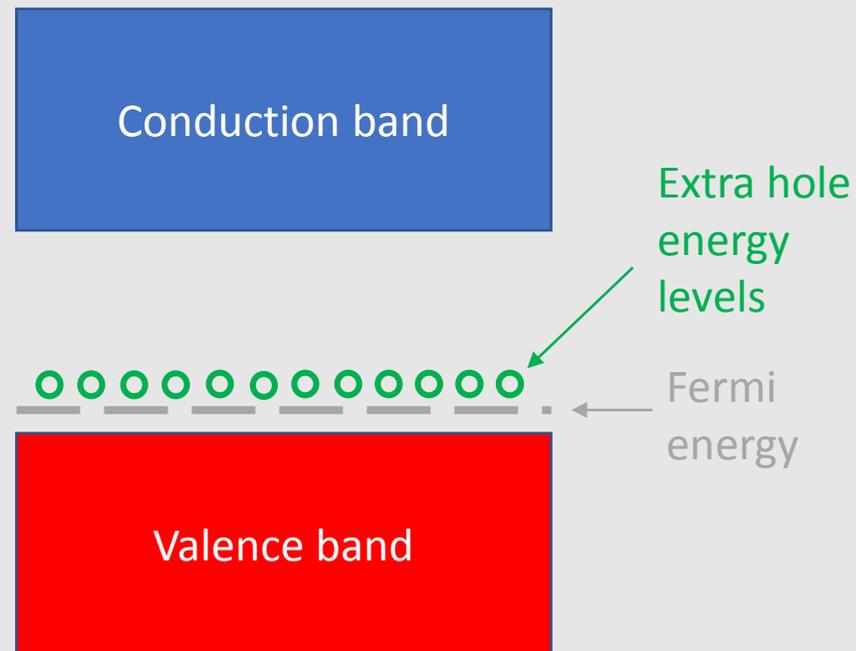
Summer student sessions 2018

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# GaN semiconductors

- III/V semiconductor
- Applications in LEDs, blue lasers



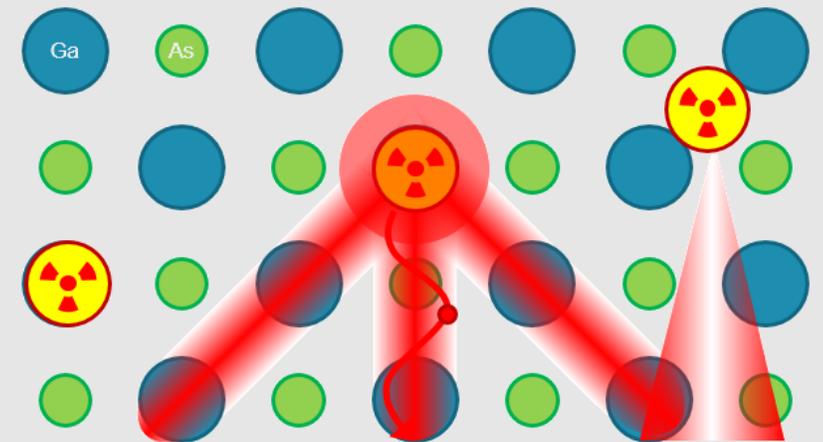
[Wikipedia.org/wiki/galium\\_nitride](https://en.wikipedia.org/wiki/galium_nitride)

# GaN semiconductors

- P-type doping poorly understood:  
Inherent doping limit
  - Where do the dopant atoms go?
    - substitutional
    - interstitial
- Need lattice location measurements

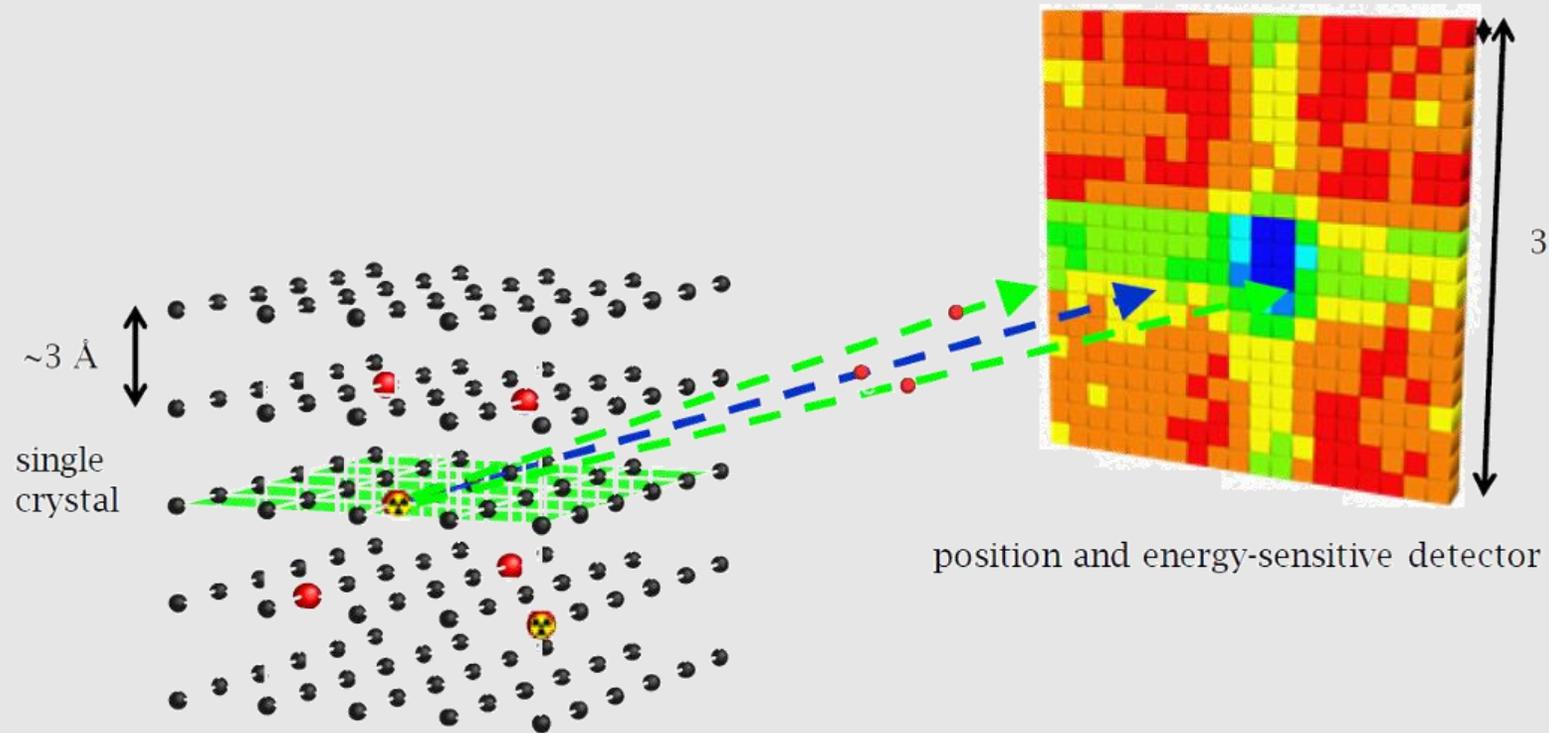
# $\beta^-$ emission channeling technique

- Implement short lived isotopes
- $\beta^-$  emission guided by the crystal potential
- Measure angle-dependent emission of electrons with a 2D position-sensitive detector



Tiago Lima, 2017

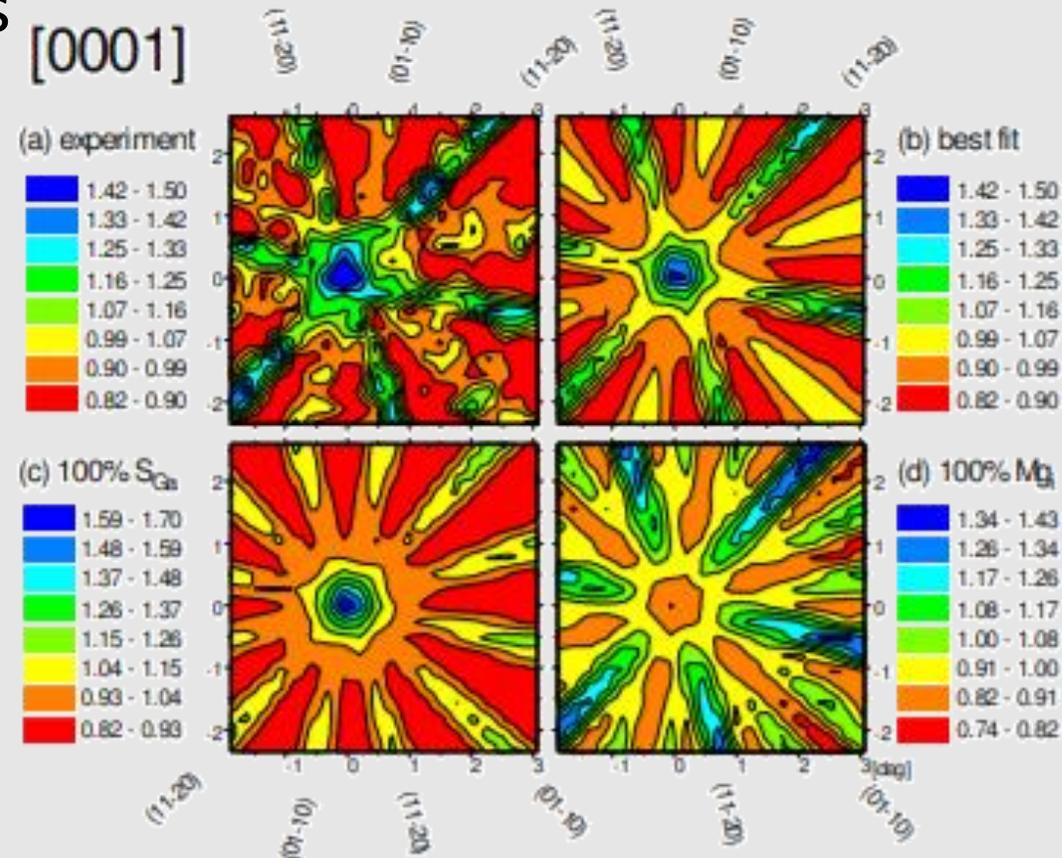
# $\beta^-$ emission channeling technique



Ulrich Wahl and the EC collaboration

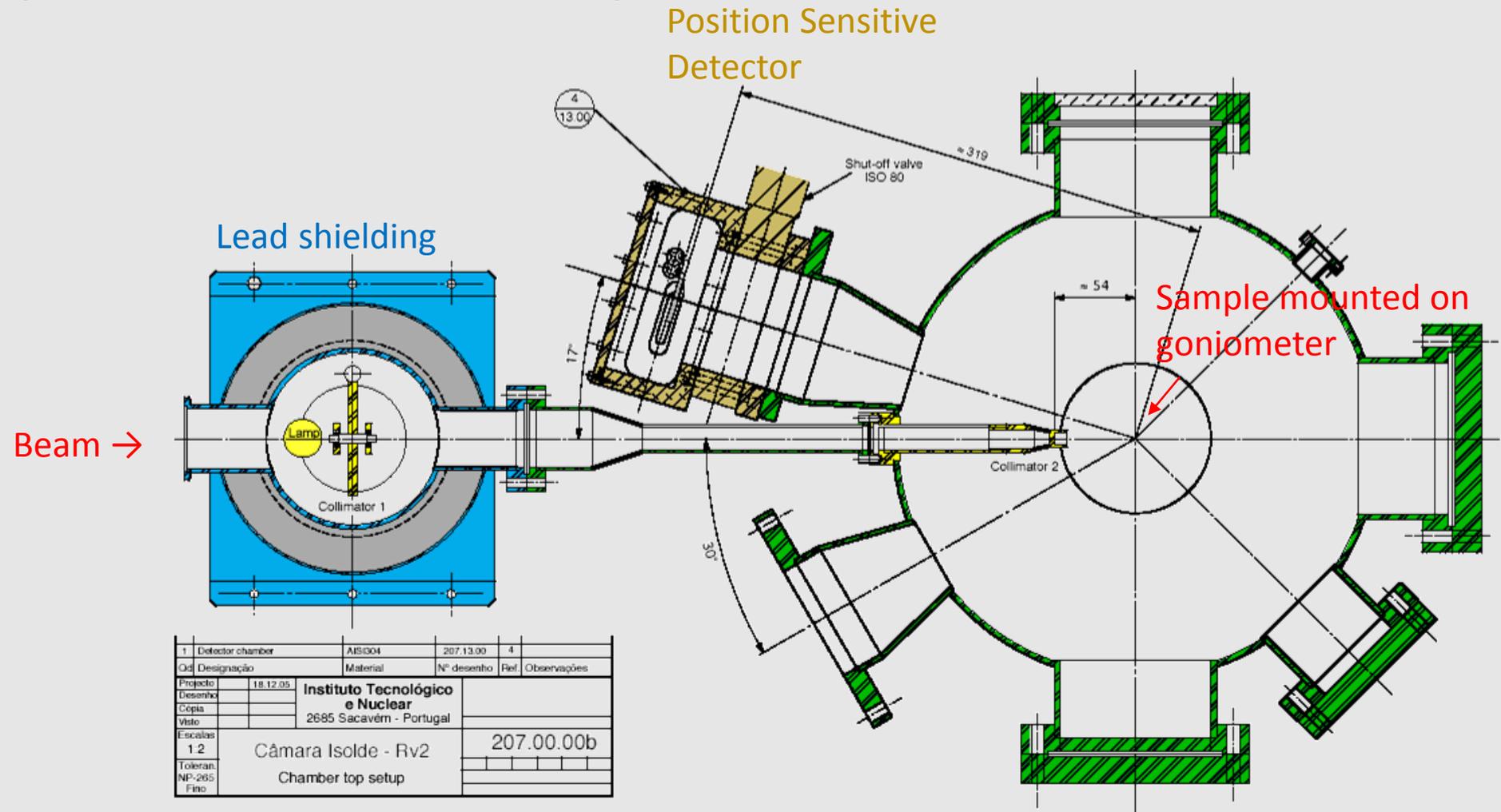
# $\beta^-$ emission channeling technique

- Fit to the emission patterns to figure out the position of the dopant atoms

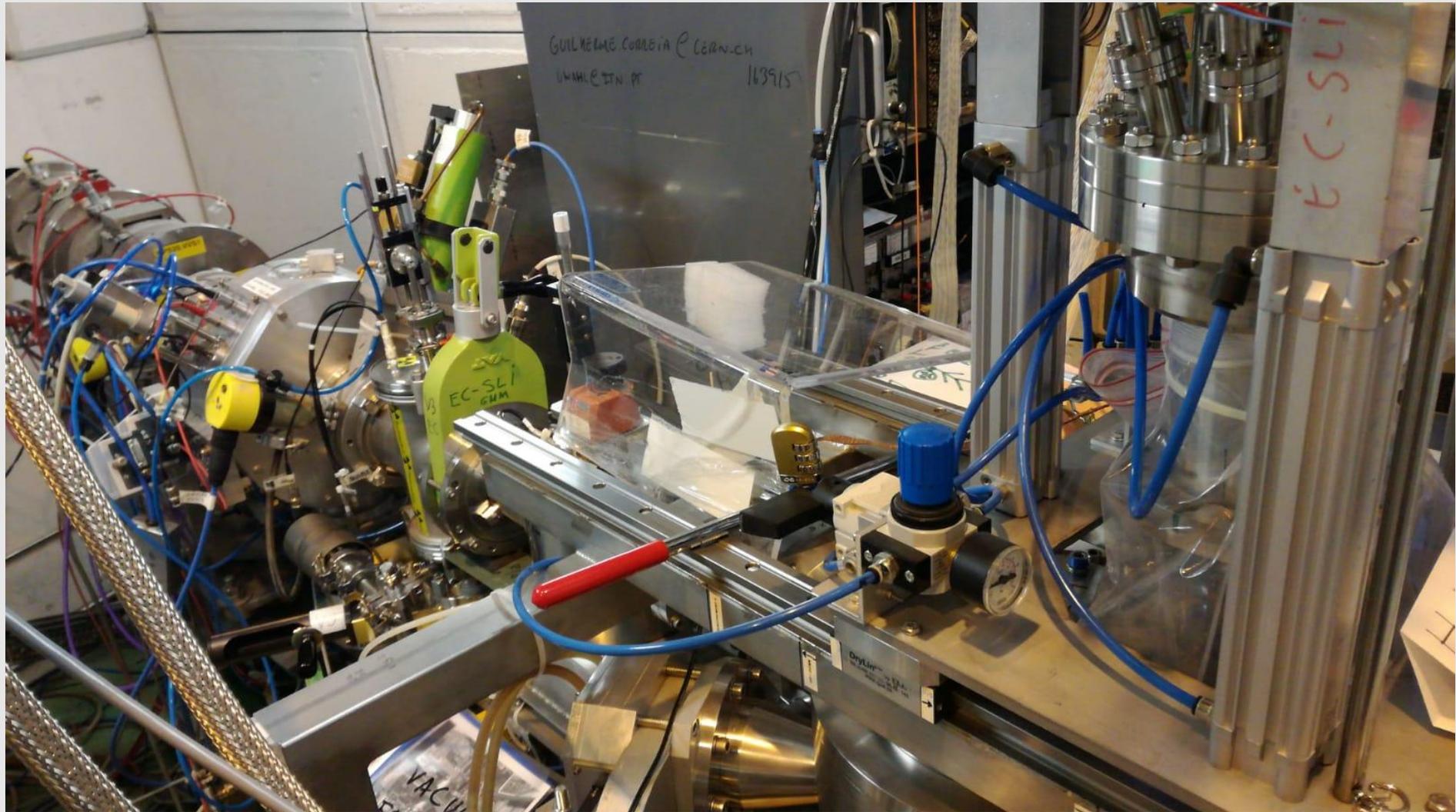


U. Wahl et al., Physical Review Letters (2017)

# Experimental setup



# Experimental setup



# Future work

- Implementation of an interlock system to protect the detector
- Vacuum, heating and cooling tests & calibration
- Experiments on  $^{11}\text{Be}$  doped GaN
  - Very short lived ( $t_{1/2}$  14 s), so hard to get high enough concentrations of implanted ions
  - High decay energy, can damage the crystal structure